Colorado Department
of Public Health
and Environment

May 15 2002

Mr Joe Legare
Assistant Administrator for Environment and Infrastructure
U S Department of Energy-RFFO
10808 Highway 93, Unit A
Golden CO 80401-8200

RE Conceptual Design for the Present Landfill Closure Cover

Dear Mr Legare

The Colorado Department of Public Health and Environment and the Environmental Protection Agency have reviewed this report, which has been described as a 30% Design Document While we understand this is supposed to be a conceptual plan, we cannot see how the process will proceed when major items are excluded from the document Overall, there is a lack of substantive basis to support numerous statements and proposals within the document We have identified major deficiencies associated with the entire document, from the cover layer components and the lack of a biota barrier, and ventilation system design flaws, to lack of sufficient information on the water balance, settlement, stability, treatment and control system, and performance monitoring program These issues warrant resolution prior to proceeding with further design work Please see the attachments for additional details and specific comments on this document

Also, we are aware that you would like to use available data and lessons learned from the Rocky Mountain Arsenal and other applicable sites in lieu of employing test plots to demonstrate viability at the present landfill You began to develop this approach in the White Paper entitled Update on Testing and Monitoring Requirements for Alternative Covers in the Western United States dated August 28,2001, however, the comments that we transmitted to you on this document have not been addressed to date The demonstration that test plots are not necessary prior to constructing the alternative cover remains to be validated and documented A more rigorous design and monitoring program (as if the entire cap is a test plot) must also be utilized and included in the design document if this approach is to be realized

If you have any questions concerning these comments, please contact Carl Spreng (CDPHE) at 303-692-3358, Elizabeth Pottorff (CDPHE) at 303-692-3429 or Jean MacKenzie (EPA) at 303-312-6258

Sincerely,

Steven H Gunderson
RFCA Project Coordinator
Colorado Department of Public Health and Environment

Tim Rehder
Rocky Flats Project Manager
Environmental Protection Agency

Attachments (2)

cc Scott Surovchak, DOE
Dave Shelton, K-H
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Dyan Foss, K-H
Dan Miller, AGO
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evapotranspiration cover by eating and/or clearing the vegetation and increasing the permeability of the cap to water via the burrows These animals may also bring significant amounts of contamination to the surface as they excavate their borrows The conceptual design for the cover should be revised to include a biota barrier to prevent burrowing animals from bringing contaminated waste to the surface In addition to maintain the integrity of the soil cover, the long-term monitoring plan for the landfill cover should address monitoring and corrective actions for burrowing animals

4 The document indicates that asbestos waste currently disposed in the present landfill may need to be relocated Disturbance of asbestos containing waste should be avoided or minimized whenever possible to reduce the possibility of creating asbestos emissions If the asbestos containing waste must be relocated, compliance with the substantive requirements for disposal of asbestos waste would be necessary, including, at a minimum authorization by the regulatory agencies to relocate the waste, documentation of the disposal location, quantity, and depth packaging and placement requirements, and record keeping (CDPHE 2000)

5 Because the proposal appears to be that the site will function as a test plot until sufficient monitoring justifies otherwise the monitoring program should include the full spectrum of testing Furthermore if the Department of Energy (DOE) will be responsible for the landfill after closure, the document should clearly state this fact, as well as discuss that it will be monitored in perpetuity

SPECIFIC COMMENTS

1 **Executive Summary, Performance Modeling, Page ES-2**

This section discusses performance modeling The third sentence states that the UNSAT-H model was used to compare the ET cover's effectiveness " It is not clear to what the modeling was being compared The sentence should be revised to indicate that the model was run using inputs representative of site-specific parameters and the model outputs are presented and compared to each other in the document

Also please note that many of the sections of the Executive Summary warrant revision per the following comments Please make the appropriate changes in this section as well

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ATTACHMENT 1
EPA COMMENTS ON THE
CONCEPTUAL DESIGN FOR THE PRESENT LANDFILL CLOSURE COVER
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
GOLDEN, COLORADO

GENERAL COMMENTS

1 Throughout the document, the narrative states that performance modeling was used to demonstrate performance of the evapotranspiration (ET) cover Because modeling does not in fact "demonstrate" performance, the narrative should be revised to state that modeling was used to "predict" performance of the ET cover and this concept should also be reflected in the entire document.

2 The document is titled conceptual design for an ET cover Therefore sufficient information should be provided to indicate that the conceptual design is likely to achieve design goals However, the document does not provide sufficient justification, in the form of site-specific tests or references, to support key concepts of the design For example, a key component of the conceptual design is seep treatment and control, but justification to support the concept that seep treatment is likely to be achieved, is not presented The document, in general, is much too vague even for a conceptual design and should therefore be revised to support the design of key components of the system

As discussed in the Specific Comments, deficiencies and inconsistencies exist in the conceptual design of some key components including, but not limited, to the following

- the equivalence between the model of the prescriptive Resource Conservation and Recovery Act (RCRA) Subtitle C cover (with gas vent and biota barrier layer) and model of the proposed equivalent cover
- the gas vent system design and construction
- the seep treatment and control system
- settlement and slope stability analyses
- water balance for the system
- UNSAT-H model parameters

The document should be revised to address these deficiencies and inconsistencies

3 The landfill cover does not include a biota barrier Burrowing animals such as prairie dogs, pocket gophers as well as badgers may compromise the integrity of an

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2 **Section 2 2 5, Page 16** This section discusses model layering Figure 3 shows the modeled cover cross sections It appears that the modeling effort does not compare equivalent features Because the landfill is a hazardous waste landfill, a prescriptive RCRA Subtitle C cover should be used as the basis for comparison The typical prescriptive cover should include the following components a 2-foot thick clay barrier, a 20-mil geomembrane, a 12-inch thick drainage layer or layer of geotextile, and a 2-foot thick layer of vegetated soil A 1-foot thick gas vent layer is placed under the clay liner if required A comparison of the modeled cover cross-sections illustrated in Figure 3 indicates the following

a The modeled prescriptive cover does not include the drainage layer or the gas vent layer whereas the ET cover includes the gas vent layer

b In the ET cover there is a geotextile fabric above the gas vent layer Because the geotextile is pervious it appears that this fabric will allow gas to reach the root zone of the plants and will not function effectively as a gas barrier

c The modeling effort should compare 'apples and apples This section should provide a basis for selecting the section modeled and discuss the apparent differences between the modeled cross-sections

d The biota barrier was not included in the sections analysed

The model of the prescriptive cover and the proposed ET cover should have equivalent layers, the combined function of which are equivalent to the RCRA Subtitle C prescriptive cover

3 **Section 2 8, Page 22** This section discusses design life The first sentence states Since an ET cover is constructed of unconsolidated soil it can accommodate differential settlement without damage or loss of integrity "

The term unconsolidated soil should be defined and a discussion should be provided of the parameters used to quantify the term Also, differential settlement could lead to ponding and the development of depressions or potholes on a cover These could also lead to the formation of pipes resulting in hydraulic failure of the cover The terminology in this paragraph should be revised or additional narrative should be provided to clarify the meaning of the terms

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4 **Figure 4, Page 26** It is not clear what this figure is representing Is the entire cover supposed to be ET? If so, it should be represented as such in the figure as well as in the entire document If not, this design must be further supported

5 **Section 3 2 2 1, Page 30** This section discusses soil-rooting medium The last sentence refers to "significant fraction of silt and clay size particles " The term "significant fraction" should be quantified

6 **Section 3.2.2 2, Page 32.** This section discusses the gas-venting layer The first paragraph states that the purpose of the gas-venting system is to provide a well oxygenated root zone As discussed in Comment 2, it is not clear how a gravel layer underlying a pervious geotextile can function effectively to prevent methane from attacking the root zone This section should discuss the design of the gas-venting layer and its function, and revise the design as needed

7 **Section 3 2.2 4 1, Page 34** This section discusses seep treatment and control The fourth paragraph indicates that the seep produces 2 to 3 gallons per minute and vegetation can typically utilize approximately 3 acre-feet per year The site-specific basis for these numbers should be provided

The fifth paragraph also indicates that several different plant species will be used in the ET apron and the main ET cover, and implies that the KH Ecology Group has selected appropriate plant species for use in the site-specific applications It is not clear that this site-specific information exists The specific basis for these statements should be provided

This section should more fully discuss water quantity and water quality issues and provide a more substantive basis to support the proposal that the system will treat and control the seepage

8 **Section 3.2.2.4 2, Page 35** This section discusses the source of the soil for use in the proposed ET apron and indicates that the soil from the ET apron excavation is acceptable for use for the various components of the cover However, no information is provided on the soil characteristics nor is an actual grain size distribution curve introduced or discussed to support the statements indicating that the soil will be acceptable even after processing The section should be revised to provide a more

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substantive basis to support the proposal that the soil from the apron excavation will be acceptable

9 **Section 3 2 3, Page 36** This section discusses storm water control The fourth paragraph indicates that the final topsoil should have a permeability of 8 centimeters per hour (cm/hr) to allow infiltration of heavy rainfall It is not clear if the permeability assumes unsaturated or saturated flows and refers to as-built conditions or long-term conditions It is not clear how this specification will relate thickness of topsoil layer soil type placement conditions, and the permeability performance requirement It is also not clear how the performance of the topsoil layer (permeability of 8 cm/hr) is accounted for in the prediction of flow in the model which has a top layer with a permeability of 1 8 cm/hr This section should provide a more substantive basis to support the recommended top soil permeability specification The specification should be consistent with the layer concept described in previous sections, including but not limited to Section 2 2 5 Model Layering and Section 2 3 Cover Soil Properties

10 **Section 3 2 5 3, Pages 47 & 48**

Provide support for the statement that the primary waste settlement will occur within approximately the first five years of placement and other statements that the most primary settlement has already occurred This does not seem to take into account the construction and existence of the new cover nor does it seem to jive with the data provided in Table 5 How will the installation of this cover impact the present system? The parameters that were used to run each model should be included Also, the Sowers Method results in Table 5 seem to indicate ponding will be present within the cover This needs to be further evaluated and the design modified accordingly

11 **Section 3 2 6 1, Page 50** This section discusses the existing gas vents It indicates that the vents will be easily removed by pulling them out or plugging them with bentonite This implies that the geomembrane portion of the existing vent system will be left in place It is not known if the geomembrane is a geotextile or a geomembrane liner If the existing system has a geomembrane liner and the new gas venting system is then placed over the existing plugged system in accordance with the design concept shown in Figure 10 the new system will have no access to the gases trapped under the old system The new vents will therefore serve no purpose Thus, details of the existing system should be evaluated to determine if it is necessary to perforate the geomembrane liner of the existing system to allow gases to access the new system

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This section should be revised to include the results of the evaluation and the revised design concept.

12 **Section 3 2 6 2, Page 50** This section discusses the East Landfill Pond and Dam The last sentence of this section indicates that "the ET apron, located over the same area as the current pond and dam, will provide similar wetland type habitat as an offset for removal of the pond and surrounding wetland " However, the last paragraph on page 34 states "The ET apron is designed to provide enough increased evapotranspiration to eliminate the seep " It is not clear if the proposed design will create wetland or eliminate the seep A credible preliminary water balance study should be performed for the entire system, including the surface water and ground water regimes, to support the design concept. The results of this study should be included in this document to provide a more substantive basis to support the conceptual design

Also, concerning wetlands mitigation, the third sentence of the second paragraph in Section 2 6 should be revised to say that the wetlands mitigation will be defined with input from the regulatory agencies ("will", as opposed to "should").

13 **Section 7, Page 82** This section discusses the monitoring plan The first paragraph states that the purpose of action monitoring is to anticipate performance failure before it happens However, the section does not discuss the actions to be taken in response to indications of failure The section should be revised (and probably given a new title) to include a response plan that lists criteria and action levels, and describes actions to be taken when action levels are reached

14 **Section 7 2.3, Page 86** This section discusses the use of lysimeters The second paragraph states that lysimeters are not recommended at the site because methane levels are high enough to affect rooting depths, transpiration rates, and cover performance Furthermore, lysimeters are sealed at the bottom and would not be subjected to landfill gas flux These statements are confusing They give the impression that the design intent is to subject the proposed new ET cover to landfill gas flux If this is the design intent then the purpose of the gas vent layer is confusing It appears that an effective gas vent layer with a geomembrane layer (instead of geotextile layer) over the granular vent layer will prevent methane from affecting roots and simultaneously isolate the soil rooting layer and other layers, such as a biota barrier, above the geomembrane A lysimeter installed with the bottom liner located on top of the geomembrane that overlies the granular vent layer will be consistent with the

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design of an effective gas vent system and a functional lysimeter This section should reconsider the use of lysimeters and the design of the gas vent system should be revisited

15 **Appendix A, Section A 4 2, Page A-26** This appendix discusses the UNSAT-H modeling effort This section discusses rooting depth The second paragraph indicates the data shows that dense vegetation was present only where significant free oxygen concentrations are found below a depth of 3 feet This suggests that the minimum thickness of the soil rooting layer above a venting layer should be 3 feet The type, thickness and features of the layered ET cover system should be revised to include at least a 3-foot thick soil rooting layer

The last paragraph in this section states The effects of landfill gas on cover performance is summarized in Attachment A1 Figure A1-7 It is not clear how effects of landfill gas on cover performance" was modeled Because UNSAT-H is basically a hydraulic model, the narrative should state that the effect on percolation due to inclusion of a gas vent layer in the layered system is shown in Figure A1-7 In addition as previously mentioned it is not clear how the gas vent layer will function to prevent methane from accessing the soil rooting layer without a geomembrane (and not geotextile) between the rooting layer and the gas vent layer

16 **Appendix A, Section A 4 3, Page A-28** This section discusses the layering system of the conventional cover selected for analysis As discussed previously, the prescribed RCRA Subtitle C cover system includes a drainage layer and a biota barrier layer This section should be revised to include a biota barrier layer

17 **Appendix A, Section A 5, Page A-31** This section presents the overall results and conclusions of the modeling effort The first bullet indicates that the proposed cover is equivalent to the conventional cover Because the conventional cover analyzed did not include the prescribed drainage and biota barrier layers this statement is inaccurate Additional modeling should be performed on the revised prescribed layered system

Also, because the field test results (Appendix A Section A 4 2 Page A-26, Second Paragraph) indicate that adequate depth of free oxygen in the root zone is a major design consideration the proposed cover should include a 3-foot thick soil rooting layer at a minimum As previously discussed a geomembrane liner should overlie the granular gas vent layer and a biota barrier should also be included in the model Additional modeling should be performed on the revised proposed layered system

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18 **Appendix B, Section B 2.2, Page B-12** This appendix discusses feasibility of using an ET cover This section discusses ET cover performance and indicates that the report compares results from UNSAT-H modeling of a conventional cover and the proposed ET cover Specific Comment 2 presents issues about the comparison of the model results

19 **Appendix H** This appendix shows geotechnical testing results for candidate off-site borrow soils The results should be amended to show the density of all samples used in performing saturated and unsaturated flow tests

References

Colorado Department of Public Health and Environment (CDPHE) 2000 *Regulations Pertaining to Solid Waste Disposal Sites and Facilities* 6 CCR 1007-2 September 1

Daniel B Stevens & Associates (DBSA) 2001a *Preliminary Draft Work Plan, Modeling and Conceptual Design, Evapotranspiration Covers at RFETS* July 23

DBSA 2001b *Update on Testing and Monitoring Requirements for Alternative Landfill Covers Int eh Western United States* August 28

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ATTACHMENT 2
CDPHE COMMENTS
CONCEPTUAL DESIGN FOR THE PRESENT LANDFILL CLOSURE COVER
ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE
May 14, 2002

General Comments

1 The most critical component for a successful ET cover is the soil As you know, the material must be capable of supporting vegetative growth as well as hold moisture during periods of low or nonexistent evapotranspiration Adequate moisture retention properties, as shown through moisture characteristics curves and saturated hydraulic conductivity, must be demonstrated for the range of soils proposed for use by specific laboratory testing and appropriate numerical modeling Inputs used for the modeling must consist of actual material properties, as opposed to using assumed values selected from design charts or other projects Once this information is obtained, an "Acceptable Zone' can be developed, where standard soil "index properties" (i e , gradation, Atterberg limits) can be used to qualify material for use in cover construction Currently, there is no detailed procedure discussed in the Conceptual Design as to how this will be accomplished

2 Construction techniques used for an ET cover are quite different than those used for virtually any other earthworks project The primary reason for this difference is due to the required low compaction range of the soils, which must be able to support vegetative growth Although stated several times in the document that this type of construction is "standard" in the industry, CDPHE believes that placing soils between 80% to 90% of the maximum standard Proctor density is unusual for most earthwork contractors, and may be more difficult to achieve than placing soils at higher densities normally used for structural applications CDPHE has previously expressed this same concern in Comment 4 submitted for the Preliminary Draft Work Plan

Based on experience, CDPHE does not share the same optimism that ET cover construction is simple and uncomplicated We would like to evaluate a full-scale field construction demonstration of the proposed ET cover, prior to actual cover construction This demonstration, similar to the use of a test pad for compacted clay liner constructability, should use the same equipment, specifications, and QC/QA testing that is planned for the actual cover construction This demonstration should be planned for in the project schedule In addition, the project designers may want to consider a "method" specification rather than a "performance" specification for cover construction, or, require the construction subcontractor to provide a detailed work plan that the regulatory agencies can evaluate

3 CDPHE will not accept the minimum 2-foot thick ET cover recommended in the report The report states that modeling shows that the 2-foot cover is equivalent to a conventional cover Not only do we question some of the input values to the numerical

modeling, there is also no field demonstration of the performance for a 2-foot cover In addition, covering hazardous waste for the 1,000-year design life requires some conservatism to account for potential construction imperfections. RFETS should seriously consider a minimum 4-foot cover Soil loss through erosion must also be accounted for during the 1,000-year design life The project designers must consider placing an additional amount of soil during construction to account for long-term soil loss

4 The maximum slope described, up to 14%, is far beyond the EPA guidance for ET covers In addition to the potential excessive erosion that occurs through gully and channel formation for slopes steeper than about 5%, vegetative establishment may also prove difficult ET covers for hazardous waste have never been constructed on slopes this steep While we understand the difficulties and costs associated with designing a flatter slope in this area due to existing topography, regulatory approval will not be obtained until the 14% slopes are flattened Alternatives such as additional grade fill, or using a composite cover (compacted clay and geomembrane) in the areas with steep slopes should be considered in order to achieve goal of addressing slope stability to minimize erosion/slumping This concern was previously expressed as Comment 10 for the Preliminary Draft Work Plan.

5 The use of lysimeters for measuring percolation through the cover has not been recommended in this document Other than lysimeters, CDPHE is not aware of any other technique that can provide this direct measurement As stated throughout this document, the ET cover will be designed to "minimize surface infiltration through the cover to levels that equal or outperform standard regulatory design" The only way to conclusively show that this is being achieved is through direct measurement The use of HDSs or TDRs will not provide the information needed to show that the cover is performing satisfactorily from a regulatory perspective Please include lysimeters within any proposed post-construction performance monitoring

6 Consistent with RCRA closure regulations and the Technical Guidance Document EPA/600/R-93/182 "Quality Assurance and Quality Control for Waste Containment Facilities", an *independent* Construction Quality Assurance Engineer (CQAE) should be brought into the project, and fully discussed in future design efforts The CQAE is responsible for independent certification that the cover construction is consistent with the design requirements This independent oversight should be supplemental to the Construction Quality Control (CQC) activities to be performed by others for the various earthworks, aggregate, piping, and geosynthetics components The inspections and tests that are performed by both the CQAE and CQC are normally summarized in a matrix for clarification

7 There are numerous inconsistencies and contradictions between and within sections in the document, these should be addressed in subsequent design documents The duplication of discussions should be reduced in subsequent design documents, to assist in minimizing inconsistencies Additionally there should be a consistent use of the terms for the erosion protection layer and soil rooting medium

Specific Comments

8 Section 2 2 3, page 14, 3rd par – The discussion concerning the percent of bare soil at the Rocky Mountain Arsenal (RMA) appears low Test cover inspections at RMA (i e , June 4, 2001) have shown that bare soil, even after the establishment of vegetation, is in the range of about 40% to 55% of the total ground area Therefore, the 2% to 5% inputs used for the UNSAT-H modeling are too low, and probably produced unreasonably optimistic results The model should be rerun with more realistic numbers

9 Section 2 2 3, page 15, 3rd par – For final design modeling the appropriate soil tests need to be conducted on the selected source material so these parameters are the best estimates possible

10 Section 2 3, page 18 – The bulleted data shown should include additional information, such as the number of tests, the range of the values, and the average value for each of the parameters

11 Section 2 5, page 20, second bullet – Will soil erosion be monitored? What contingency plans will there be for excessive erosion?

12 Section 2 5, page 20, third bullet – Reference is made to future engineered storm water control measures Subsequent sections indicate that storm water control measures outside those that are inherent to the design of the ET, will be managed by the RFETS storm water control system For No Name gulch the only storm water control system is the Landfill Pond No Name gulch is a drainage that intersects Walnut Creek about one-mile east of the Landfill There are no actual ' storm water control structures" along this segment of Walnut Creek

13 Section 2 6, page 21 – This discussion of wetlands impacts is confusing, the ideas suggested here need to be explained more fully These statements are inconsistent with subsequent discussions on elimination of the existing seep and presumed construction impacts to existing wetlands around the landfill pond

14 Section 2 9, page 22 – Any discussion of ET soil construction specifications should include moisture requirements For ET covers, a specification for moisture to be below the optimum moisture content should be included

15 Section 3 2 2 1, page 31 – Reference is made to slope stability present at RFETs There are numerous areas that exhibit active slumping and erosional surfaces on various slopes, including areas around the landfill Such features should be kept in mind during the design process and take into consideration the potential of certain native materials e g , colluvium or RF alluvium, which may be considered as potential borrow materials, to exhibit characteristics that may be more conducive to erosion or slumping

16 Section 3.2.2.4, page 33 – The State does not think elimination of seep caused wetlands is consistent with other site objectives Does the seep currently exceed surface water quality stream standards for Segment 5 of Big Dry Creek (5 CCR 1002-38)? What is the source of the seep – infiltration through the landfill or groundwater infiltration on slopes into No Name Gulch? Are the constituents conducive to natural attenuation over current exposure to ambient conditions? Assuming that the ET apron with the trench structures (i e , infiltration galleries) will be implemented, and the seep water not exposed to ambient air

17 Section 3.2.2.4.1, page 34 – The discussion on the ET apron appears to indicate that the apron will be used for "treatment" of water from the seep, which may have other regulatory or stewardship implications for future management of the landfill A question that should be considered in the design of the subsurface trench system proposed for management of seep water, is what happens if the point of saturation is attained in the trench system? Where will the shallow groundwater discharge, and could that discharge have an impact to waters of the state? Will the use of the trench system achieve natural attenuation for the constituents of concern?

Additionally, the ET apron design appears to eliminate the landfill pond, which has been designated a water of the state Implications of the closure of the pond as part of the landfill closure requires discussion

18 Section 3.2.3, page 36 – Are the storm water control measures discussed in this section part of the optional ET apron, or separate? Additionally, the closure design requires consideration of the existing method of storm water control for the landfill area Outside of the landfill pond, there are no other storm water control measures for No Name Gulch

Additionally, if the landfill pond is eliminated and the seep remains (ET apron not constructed), how is the seep water to be managed?

19 Section 3.2.3, page 36, 4th par – How has the topsoil design specification been evaluated against the soils being considered?

20 Section 3.2.5.1, Table 3, page 45 – The wet bulk density of the landfill gas-venting layer seems low The layer is described as aggregate consisting of clean gravel with minimal fines This material is assumed to classify as a poorly sorted gravel (GP), according to the USCS Average dry densities for GP soils are about 112 to 137 pcf, with a moisture content of about 6 5% (Design of Small Dams, U S Bureau of Reclamation, 1987) Therefore, we assume that an average value for the wet bulk density of GP soils are about 119 to 146 pcf, which is much denser than the 96.3 pcf shown

21 Section 3.2.6.3, page 51 - An understanding of the hydraulic control of the existing surface water diversion ditch is required before a decision is made to eliminate the ditch Does the ditch actually recharge groundwater infiltration in the landfill area, or does it actually divert water away as designed?

22 Section 3 3 2, page 60, 3rd par – Prior to committing resources to a particular borrow source, lab testing should be performed to obtain actual material properties The specific soil properties should then be input into the UNSAT-H model in order to verify that the proposed materials will be acceptable An "Acceptable Zone" as well as construction specifications can then be developed for the ET cover See Comment 1

23 Section 3 4 2, page 68, Table 8 – The extra soil available in the asbestos relocation option should be considered to decrease the unacceptable slopes proposed

24 Section 4 3, page 73 – If the seep is eliminated by placement of the ET apron, then what will be the alternate source of water for irrigation? If the landfill pond is eliminated, what is the structure for storage of irrigation water?

25 Section 6 1, page 78 – There are no other storm water management basins downstream in No Name Gulch See comments 12 and 18

26 Section 6 2 3, page 80 – The results between the runoff methods is significant The use of infiltration value of 3 in/hr seems very conservative The evaluation should be expanded to include lesser infiltration rates, to see the differences in flow rates under other projected conditions

27 Section 7 2 3, page 86 – Lysimeters must be the major component of the performance monitoring See Comment 5

28 Section 7 3, page 87 – The cover monitoring should be performed at a frequency greater than each quarter Typically, monthly monitoring is initiated until equilibrium is approached At that time, a reduced monitoring effort, potentially each quarter, can be considered

29 Section 7 3 1, page 87 – The Phase I Monitoring program does not include a discussion of water quality monitoring (assumed to include surface water and groundwater) as is mentioned in the Phase II Monitoring Program Such a discussion needs to be incorporated in future design

30 Section 7 3 1, page 87, 3rd par – Please explain what "action monitoring" means

31 Sections 7 3 2 and 7 3 3 – The discussions need to be expanded so one can determine if water quality sampling includes surface water and ground water

32 Section 7 3 3, page 88 – The last sentence assumes that 30-years is the end of the monitoring period This is not necessarily correct Although 30-years is typically the post-closure monitoring period, monitoring for this facility should continue until the system essentially achieves equilibrium, which could potentially be greater than 30-years A decision to end the cover monitoring will be made in the future after evaluating the cover percolation data to be obtained through lysimeters over time

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33 Section 8 1, page 90 – The second paragraph states that a detailed off-site investigation has been conducted and suitable soils have been located Please provide this information to CDPHE for review

34 Section 8 2, page 91 – Onsite borrowing needs to ensure the ground water table remains at a depth that will not encourage phreatophyte development unless it is part of a PMJM habitat enhancement

35 Section 8 2, page 92, 2nd par – For clarity, provide the ASTM or other testing designations with the bulleted items shown Also, what are the differences between "standard Proctor compaction", "dry bulk density", and "particle density"?

36 Section 8 2, page 92, 3rd par – Rather than estimate cobble percentages based on observed drill cuttings, actual sampling and lab testing (gradations) through the use of test pits or trenches should be performed

37 Section 8 3 3, page 95 – Although it is up to the construction subcontractor to determine means and methods for soil excavation and placement, the use of scrapers for placement of the ET cover should not be allowed Scrapers tend to compact soils, which will inhibit vegetative growth on the cover In fact, as a selling point, the Caterpillar Equipment Company web site states the following "Caterpillar scrapers load quickly, have high travel speeds, and *compact as they dump* and spread on the run" It is not acceptable to assume that overcompaction will take place, and then adjusted by disking or other means to loosen the soil

38 Section 8 3 4, page 95 – In addition to considering adequate time frames for processing the soil and aggregate, QC and QA testing must also be considered Once the actual stockpile is developed, QC/QA testing at agreed upon frequencies must be performed Although this can be done during material placement, it is often more efficient to perform at least some of the required testing prior to actual construction

39 Section 8 3 6, page 97 – 1) Please remove the reference to "ripping", and replace it with shallow "disking" It has been shown at RMA that deep ripping will create seepage paths that may allow water to easily percolate through the cover 2) The term "low-weight wheeled vehicle" is misleading Tracked vehicles may exert low ground pressure, usually with wider treads to distribute the load, but wheel vehicles transfer their entire load (weight of vehicle plus soil it is carrying) at the point of wheel contact with the ground 3) Although drying soils to proper moisture for ET cover placement may be difficult, or even costly, if the soils are wetter than optimum, this still must be part of the placement specifications Ripping or processing soils after placement should not be viewed as the primary means to place soils within the acceptable compaction zone

40 Section 8 3 7, page 97 – Prior to placing the soil-rooting medium and erosion protection layer on the venting layer aggregate, the aggregate to the interim cover will probably be

the critical interface A slope stability calculation, using the correct density for the aggregate layer (see Comment 10) should be performed

41 Section 8 3 10, page 99, 3rd par – Please clarify how the proposed permeable conduits will distribute seep water in the shallow soils Specifically where and at what rate will the water be directed? It does not appear this option was modeled Performance of the ET apron should be tested with UNSATH

42 Section 9 1 3, page 111 – Please clarify that an *independent* CQAE will be utilized consistent with EPA guidance See comment 2 above

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